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Title Page

HOR	SUBJECT CLASSIFICATION	NO. 50TP170-1
. K. Farr (for R.P.B.) R. P. Bass	Bushings - Capacitors	DATE 7/19/51

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The Operation of 5 Kv Glass and Porcelain Bushings in Salt-Fog Atmosphere, Report II

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The Operation of 5 Kv Glass and Porcelain Bushings in Salt-Fog Atmosphere, Report II

ABSTRACT Glass and porcelain bushings were tested in a salt fog atmosphere. A leakage current, surge counter was used to study the mechanism of surface deterioration. Means for greatly reducing salt deposition and surface deterioration were developed for bushings connected to transmission lines of moisture resistant cable.

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CONCLUSIONS

1. The oversize 5 kv G.E. porcelain bushing, K-5239328 AB, G-8, had a total of 68% fewer current surges above 10 ma. and also less surface deterioration than the standard 5 kv G.E. porcelain.
2. The modified contour 14B25, 8.7 kv glass bushing had 18% fewer current surges above 10 ma. and also less surface deterioration, than the standard 14B5, 8.7 kv glass bushing.
3. Semi-conducting Rescon surface coatings, partial and complete, have so far been unsuccessful in improving the performance of bushings operated in a salt-fog.
4. Salt deposition and surface deterioration during these tests have been greatly reduced on 14B4, 5 kv glass bushings by sealing the insulated, moisture resistant cable and bushing terminal connection against moisture with Kearney "Airseal".

By cutting out this rectangle and folding on the center line, the above information can be fitted into a standard card file.

For list of contents-drawings, photos, etc. and for distribution see reverse side.

INFORMATION PREPARED FOR High Voltage Bushing Division

TESTS MADE BY B. J. Murphy, R. P. Bass and T. V. White

COUNTERSIGNED T.R. Walters 7-23-51 DIV. Laboratory, Electrical Research Section

TRANSFORMER & ALLIED PRODUCT DIVISIONS PITTSFIELD

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INTRODUCTION

This report is the second of a series entitled, "The Operation of 5 Kv Glass and Porcelain Bushings in a Salt-Fog Atmosphere". A summary of the general problem of operating bushings in a salt-fog atmosphere appears in Report I, T.I.S. Report Number 50TP170.

The present report summarizes the results of all the work performed to date and not covered by Report I.

The bushings used for these tests are of the type designed for 15 kvar power factor correction capacitors. Samples included standard G.E. glass bushings, standard G.E. porcelain bushings, and various modifications of both glass and porcelain bushings. Voltage ratings were 5 kv and 8.7 kv.

PURPOSE

The purpose of the work covered by the present report is:

1. To reduce or eliminate the deposition of salt on the surfaces of high voltage glass bushings.

2. To compare the operation of a modified contour 5 kv G.E. porcelain bushing with a standard 5 kv G.E. porcelain bushing.

3. To compare the operation of a modified contour 14B25, 8.7 kv G.E. amber glass bushing with a standard 14B5, 8.7 kv G.E. amber glass bushing.

4. To determine to what extent semi-conducting surface coatings improve bushing performance.

SUMMARY OF RESULTS

The nine photographs and eleven curve sheets grouped at the end of this report were selected to give a brief summary of the significant results of the tests conducted. Also included is a schematic diagram of the leakage current surge counter used throughout most of the test runs.

CONCLUSIONS

1. The oversize 5 kv G.E. porcelain bushing had a total of 68% fewer leakage current surges above 10 ma. and also less surface deterioration than the standard 5 kv G.E. porcelain bushing. Figures I, II, and X.

2. The modified contour 14B25, 8.7 kv amber glass bushing had a total of 18% fewer leakage current surges above 10 ma. and also less surface deterioration than the 14B5, 8.7 kv G.E. amber glass bushing. Figures III and X.

3. Semi-conducting Rescon surface coatings, partial and complete, have, so far, been unsuccessful in improving the performance of bushings operating in a salt-fog atmosphere. Figures IV, V, VI, XI, XII, and XIII.

4. Salt deposition and surface deterioration have been greatly reduced on 14B4, 5 kv G.E. amber glass bushings that had the insulated moisture resistant cable and bushing terminal connection sealed against moisture by Kearney "Airseal". Figures VII, IX, XVI, and XVIII.

LEAKAGE CURRENT SURGE COUNTER

The pitting and chipping observed on glass and porcelain bushings has been found to be caused by thermal shock resulting from arc discharges spitting across the moist bushing surfaces. The heat of these arcs was sufficient to compress localized areas of the surface in excess of the strength of the glass or porcelain glaze, and thereby cause chips to flake off. It has also been observed that the degree of surface deterioration varied from one type of bushing to another and with the amount of arcing observed.

In order to understand better these arc discharges and the effect on the arcing rate of factors such as contour design, six leakage current surge counters were constructed. Each surge counter was constructed according to the schematic diagram shown in Figure XIX. The operation of these surge counters is dependent primarily on the instability of the moisture film on the bushing surface. When one area of the bushing develops a thinner, high resistance film, a predominant amount of voltage appears across this drier area. If the voltage that appears is sufficiently great, an arc short-circuits what was formerly a voltage-carrying surface and the ampere level reached is then limited largely by the resistance of the remaining film. This increased resistance quenches the arc and reduces the leakage current to a lower value.

Briefly, the method of detecting and counting the leakage current surges is as follows: The mounting flange of the test bushing is connected to ground through the secondary winding of a 6.3/115 volt filament transformer. When an arc occurs, the current surge induces a voltage in the primary of the filament transformer which bucks the negative d-c bias on the grid of the 884 Thyratron tube. This triggers the Thyratron tube which then conducts sufficient current to operate the surge counter. The surge counter has a contact arrangement that opens the plate circuit of the Thyratron tube immediately after the counter operates. Opening the plate circuit stops the flow of current and allows the grid to regain control of the tube. The circuit is then ready to count the next current surge.

The surge counters were set to record all current surges above a crest value of 10 ma. This value may be adjusted as desired by changing the negative bias voltage. Figure XX shows a curve of the crest value of leakage current surges vs. the magnitude of the negative bias supply.

Observations made with the use of a G.E. wide band oscilloscope have shown the surge counters to be very reliable.

DESCRIPTION OF MATERIAL TESTED

1. Standard 14B4, 5 kv centrifugally cast, amber, A50P69 glass bushings.
2. Standard 14B5, 8.7 kv centrifugally cast, amber, A50P69 glass bushings.
3. Modified contour 14B25, 8.7 kv centrifugally cast, amber, A50P69 glass bushing.
4. Standard 5 kv G.E. porcelain bushing.
5. Oversize 5 kv G.E. porcelain bushings, K-5239328 AB, G-8.

METHOD OF TEST

All samples were clean and dry when placed in the fog chamber. Each run began with the application of voltage to the test samples following which the fog generator was started. The test runs were all conducted with a voltage of 2.5 kv applied to the test samples.

The sample surfaces were examined frequently during a test run and the samples were removed from the test after sufficient surface deterioration had been observed. The results of the examinations were recorded and in some cases photographs were taken. Also recorded on each run were data such as length of run, salt content of fog and applied voltage.

RESULTS

1. The results of the various tests on samples in a salt-fog conducted between August 1, 1950 and June 6, 1951 are summarized in Table I. Photographs were taken of most of the bushings following test and are reproduced at the end of this report (Figures I through IX).

2. The results of the readings taken from the leakage current surge counters on the various samples for each run are shown by the curves in Figures X through XVIII.

DISCUSSION OF RESULTS

The data obtained by the use of the leakage current surge counters indicate that, after a bushing has been operating for some time, an apparently steady flow of leakage current begins. This steady current flow practically eliminates all arcing for long periods of time. It would be interesting to know the magnitude of these steady leakage currents and their effect on surface deterioration. That their effect is considerable, is suggested by Figure III (a). This bushing operated for 278.8 hours before failing. After about the first 50 hours of the test, the rate of rise in the number of leakage current surges was negligible.

It is possible that leakage current much lower than 10 ma. may cause surface deterioration. Perhaps these low-level leakage current surges occur at a much higher rate, which more than makes up for the low current magnitude in its effect on surface deterioration.

An investigation of this hypothesis would probably shed more light on the actual phenomena of surface deterioration. This in turn would be a great help in the investigation of semi-conducting coatings used for distributing voltage stresses adjacent to either a bushing terminal or a ground flange or for producing a uniform voltage distribution over the entire bushing surface.

Although semi-conducting coatings have been unsuccessful, so far, it is worth noting (Fig. XIII) that the test samples, with internal coatings, had very few current surges in the early stages. This would lead one to believe that there may be some kind of conducting coating that would greatly reduce surface deterioration.

In locations where insulated, moisture resistant cable is used throughout the transmission lines, it is possible to reduce greatly the salt deposition and surface deterioration on bushings. This is accomplished by completely covering all bare, high voltage, conducting material at the cable and bushing terminal connection with Kearney "Airseal".

Kearney "Airseal" is a pliable high-dielectric-strength compound which is chemically inert and is claimed by the manufacturer to be unaffected by contaminated atmospheres. The dielectric strength of this material was found by test to be about 333 volts per mil. This compares with a dielectric strength of 80 volts per mil for a sample of Johns-Manville Duxseal, having the same thickness.

Tests were conducted in which Duxseal was used to insulate the bushing terminal and cable connection. However, this material did not stand up for long because of its poor dielectric strength under the high voltage stress about the bushing terminal.

The success of Kearney Airseal in eliminating the surface deterioration of the bushings is most apparent in a comparison of the photos of the protected and the unprotected bushings (Figs. III, VII and IX). The use of insulated cable and Airseal practically eliminated the current surges during the first 100 hours of the test runs and greatly reduced their number for the complete 350-hour run. It also appeared to minimize the effect of the arcing when it did occur. This may be because the Airseal, by increasing the resistance of the discharge path, reduces the magnitude of the current surges.

The increase in counting rate after 250 hours (Fig. XVIII) indicates that further investigation may be necessary to establish the life expectance for this material.

TABLE I

SUMMARY OF RESULTS OF SALT-FOG TESTS

Run No. 1 8-1-50 to 10-27-50. Test time - 550 hours at 2.5 kv.
Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

	Test Bushings	Results
(a)	Oversize 5 kv porcelain K-5239328 AB G-8	Frequent arcing, heavy tracking top petticoat. (See Fig. I)
(b)	5 Kv G.E. porcelain	Frequent arcing, scattered heavy tracking. (See Fig. I)
(c)	5 Kv G.E. amber glass	Frequent arcing, scattered heavy tracking.
(d)	5 Kv G.E. glass, coated with F 1113	Very frequent arcing, coating badly burned.
(e)	5 Kv G.E. glass, coated with R 402.	Very frequent arcing, coating badly burned.

Run No. 2 11-20-50 to 12-12-50. Test time - 300 hours at 2.5 kv.
Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings (See Figures II and III)

(a) Oversize 5 kv porcelain K-5239328 AB G-8
(b) 5 Kv G.E. porcelain
(c) 5 Kv G.E. amber glass, 14B4
(d) Modified contour 8.7 kv G.E. amber glass, 14B25
(e) 8.7 Kv G.E. amber glass, 14B5

Time on Test	Number of Leakage Current Surges above 10 ma.				
Hours	Bushings: (a)	(b)	(c)	(d)	(e)
4.6	20	1,424	640	456	1,096
16.2	1,600	8,012	3,637	3,432	4,121
31.0	2,718	18,320	12,242	3,720	7,688
42.1	4,192	41,146	24,447	6,141	10,835
82.4	33,779	141,557	26,256	11,016	30,051
100.0	50,484	146,570	26,429	11,019	65,399
106.1	50,484	157,917	30,578	11,019	70,998
120.5	50,484	174,618	31,478	11,019	73,679
131.6	50,484	188,725	33,788	11,019	74,074
144.8	50,484	194,893	34,299	48,720	74,519
154.4	52,158	199,219	35,548	55,654	79,714
172.0	54,779	248,679	36,868	64,278	89,262
180.0	56,886	263,920	37,108	67,318	91,072
186.2	57,867	272,877	37,203	69,922	101,926
200.0	58,056	276,475	37,220	85,536	102,056
210.2	73,507	279,518	37,624	91,976	116,805
222.3	89,538	293,090	39,720	104,057	120,744
248.3	98,301	301,428	41,092	104,452	120,961
258.3	99,189	305,998	41,287	105,035	121,316
270.0	101,059	309,316	41,324	105,072	121,424
278.8	104,600	312,956	44,201	107,817	124,218
291.3	104,656	326,859	(broke	108,743	131,554
300.0	104,674	333,177	in two)	108,823	131,836

Run No. 3 11-27-50 to 11-29-50. Test time - 50 hours at 2.5 kv.
Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings (See Figure IV)

(a) 5 Kv G.E. glass, 14B4, with Rescon coat over first 1-1/2 petticoats. Resistance - 1.5 megohms.

(b) 5 Kv G.E. glass, 14B4, with Rescon coat over first 1-1/2 petticoats. Resistance - 70 megohms.

(c) 5 Kv G.E. glass, 14B4.

(d) 5 Kv G.E. glass, 14B4, with Rescon coat over first 1-1/2 petticoats. Resistance - 150 megohms.

(e) 8.7 Kv G.E. glass, 14B25.

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Bushings: (a)	(b)	(c)	(d)	(e)
2.0	298	0	458	0	1,195
4.0	1,838	377	818	0	2,088
6.0	3,019	1,537	1,238	804	6,443
8.0	3,273	2,000	1,271	1,376	13,964
10.3	3,643	2,194	1,308	1,575	20,829
12.1	3,741	2,194	1,491	1,993	25,360
14.1	4,475	2,194	1,500	3,532	31,338
16.2	4,702	2,197	1,798	5,613	38,387
26.0	5,145	2,222	2,622	8,451	49,844
30.0	5,205	2,245	3,458	14,143	60,355
37.3	6,937	9,031	3,778	20,700	68,811
50.0	30,432	11,261	4,239	25,165	83,636

Run No. 4 1-8-51 to 1-12-51. Test time - 100 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings (See Figure V)

(a) 5 Kv G.E. glass, 14B4, with Rescon coat over bottom 1-1/2 petticoats. Resistance - 3 megohms

(b) 5 Kv G.E. glass, 14B4, with Rescon coat over bottom 1-1/2 petticoats. Resistance - 50 megohms

(c) 5 Kv G.E. glass, 14B4.

(d) 5 Kv G.E. glass, 14B4, with Rescon coat over bottom 1-1/2 petticoats. Resistance - 300 megohms

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Bushings: (a)	(b)	(c)	(d)
2.5	1,376	0	0	0
8.7	2,868	676	2,397	1,070
23.7	3,091	4,772	2,398	9,696
27.0	3,091	4,843	2,400	9,696
30.0	3,101	5,057	2,405	10,063
32.4	4,571	5,206	2,414	10,131
47.9	7,608	5,464	2,414	10,290
56.9	9,443	5,678	2,414	10,394
73.2	10,141	5,756	3,528	10,408
81.2	10,223	5,777	15,242	10,408
88.2	10,223	5,819	15,936	16,289
100.0	10,285	5,905	17,186	27,075

Run No. 5 1-25-51 to 2-3-51. Test time - 156 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings	Results
(a) 5 Kv G.E. glass, 14B4.	Frequent arcing, scattered heavy tracking.
(b) 5 Kv G.E. glass, 14B4, suspended from 2TW Rome Moisture Resistant Grade Cable. Duxseal covering terminal, cable and top of first petticoat.	Infrequent arcing, scattered light tracking.
(c) 5 Kv G.E. glass, 14B4.	Frequent arcing, scattered heavy tracking.
(d) 5 Kv G.E. glass, 14B4, suspended from 2TW Rome Moisture Resistant Cable. Terminal, cable connection and bushing covered with Insul X.	Frequent arcing, coating badly burned.

Number of Leakage Current Surges above 10 ma.

Time on Test Hours	Test Bushings (a)	(b)	Time on Test Hours	Test Bushings (c)	(d)
10.0	1,911	0	15.9	24,867	8
31.5	46,692	776	24.3	26,932	24
60.1	47,070	14,917	39.9	26,932	51
86.0	76,683	21,074	48.4	26,946	83
94.4	78,888	21,173	67.1	27,017	133
110.0	78,897	21,173	85.7	31,215	9,630
118.5	78,913	27,381			

Run No. 6 2-5-51 to 2-9-51. Test time - 100 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings (See Figure VI)

(a) 5 Kv G.E. glass, 14B4, with internal Rescon coating from terminal to ground flange. Resistance - 2760 megohms.

(b) 5 Kv G.E. glass, 14B4, with internal Rescon coating from terminal to ground flange. Resistance - 9000 megohms.

(c) 5 Kv G.E. glass, 14B4, with internal Rescon coating from terminal to ground flange. Resistance - 2860 megohms.

(d) 5 Kv G.E. glass, 14B4, no internal resistance.

(e) 5 Kv G.E. glass, 14B4, with internal Rescon coating from terminal to ground flange. Resistance - 42,000 megohms.

(f) 5 Kv G.E. glass, 14B4, with internal Rescon coating from terminal to ground flange. Resistance - 855 megohms.

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Test Bushings (a)	(b)	(c)	(d)	(e)	(f)
2.0	0	0	0	203	859	Counter
5.1	573	0	2,882	204	2,734	under
13.0	1,484	2,152	3,405	264	2,738	repair.
21.3	4,767	2,940	3,454	302	2,738	
30.6	22,731	3,423	3,502	38,191	2,738	
37.3	28,728	4,486	3,502	48,695	2,738	
41.4	30,243	5,732	3,540	50,439	2,749	
61.0	30,630	14,235	3,748	51,196	2,775	
68.7	30,727	14,245	3,775	51,246	2,845	
100.0	43,553	27,983	12,729	51,251	16,657	

Run No. 7 3-5-51 to 3-9-51. Test time - 100 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

Test Bushings (See Figure VII)

(a) 8.7 Kv G.E. glass, 14B25.

(b) 5 Kv G.E. glass, 14B4, suspended from 2TW Rome Moisture Resistant Cable. Terminal and cable connection covered with Kearney Airseal.

(c) 5 Kv G.E. glass, 14B4.

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Test Bushings (a)	(b)	(c)
22.4	18,228	0	487
32.0	19,716	0	2,644
46.4	45,082	0	10,614
56.8	51,583	0	12,078
68.0	62,483	0	16,332
78.3	83,789	0	20,853
92.7	84,993	0	21,945
100.0	84,993	0	22,298

Run No. 8 4-16-51 to 4-26-51. Test time - 120 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

All bushings are 5 kv G.E. amber glass 14B4 bushings connected to voltage source with Rome 2TW Moisture Resistant Cable. (See Figure VIII).

Bushing #1 - Terminal exposed.

Bushing #2)
Bushing #3) - Terminals covered with one pad (1/8" x 3" x 4") of Kearney "Airseal".

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Bushing #1	Bushing #2	Bushing #3
0	----	----	----
4	6,020	33	----
21	30,674	1,068	141
25	31,040	2,319	141
30	31,044	4,652	144
45	31,044	40,926	194
57	31,476	48,018	202
62	32,329	48,602	263
65	35,865	50,049	374
69	39,226	53,374	962
85	40,680	70,274	2,170
93	50,878	85,453	3,206
98	52,621	87,327	7,647
102	59,343	91,347	8,016
120	*	98,287	11,232

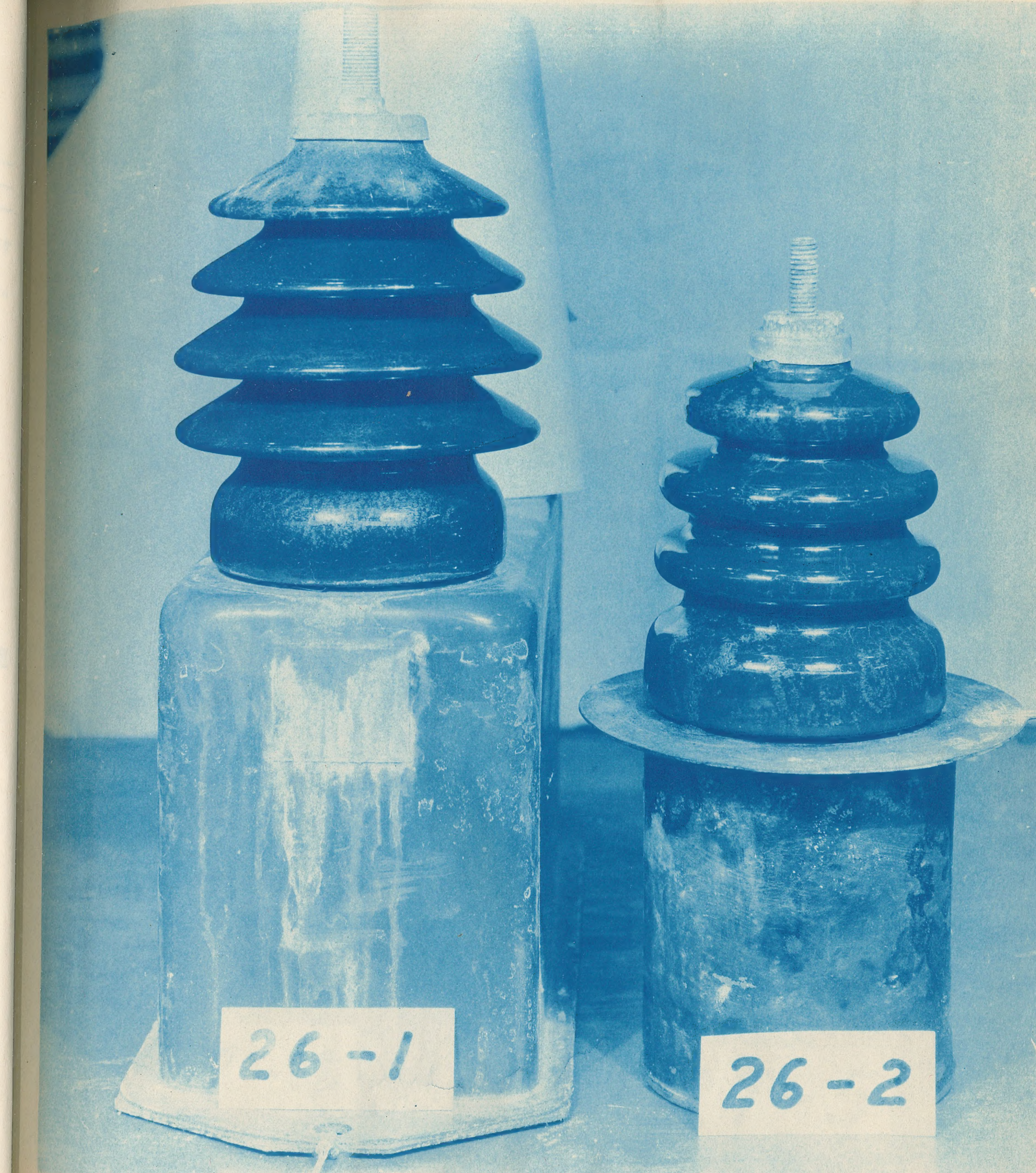
*Bushing #1 would no longer hold the voltage after 102 hours, so was removed.

Run No. 9 5-22-51 to 6-6-51. Test time - 359 hours at 2.5 kv. Salt fog contained 10% NaCl and 1.2% $MgCl_2$ by weight.

All bushings are 5 kv G.E. amber glass 14B4 bushings connected to the voltage source with Rome 2TW Moisture Resistant Cable (See Fig. XIX).

Bushing #1)
Bushing #2) - Terminals covered with two 1/8" x 3" x 4" pads of Kearney Airseal.
Bushing #3)

Time on Test Hours	Number of Leakage Current Surges above 10 ma. Bushing #1	Bushing #2	Bushing #3
0	0	0	0
25	0	0	0
32	0	0	1
48	0	0	8
72	0	0	13
144	19	63	13
169	21	63	13
216	24	63	13
240	28	81	13
249	128	477	13
316	3,251	5,924	4,122
336	4,653	6,156	4,122
359	12,927	6,496	4,408



(A) OVERSIZE 5KV PORCELAIN BUSHING (B) STANDARD 5KV PORCELAIN BUSHIN

3017367 FIGURE I RESULTS OF A 550 HOUR SALT RUN ON 5KV PORCELAIN BUSHINGS

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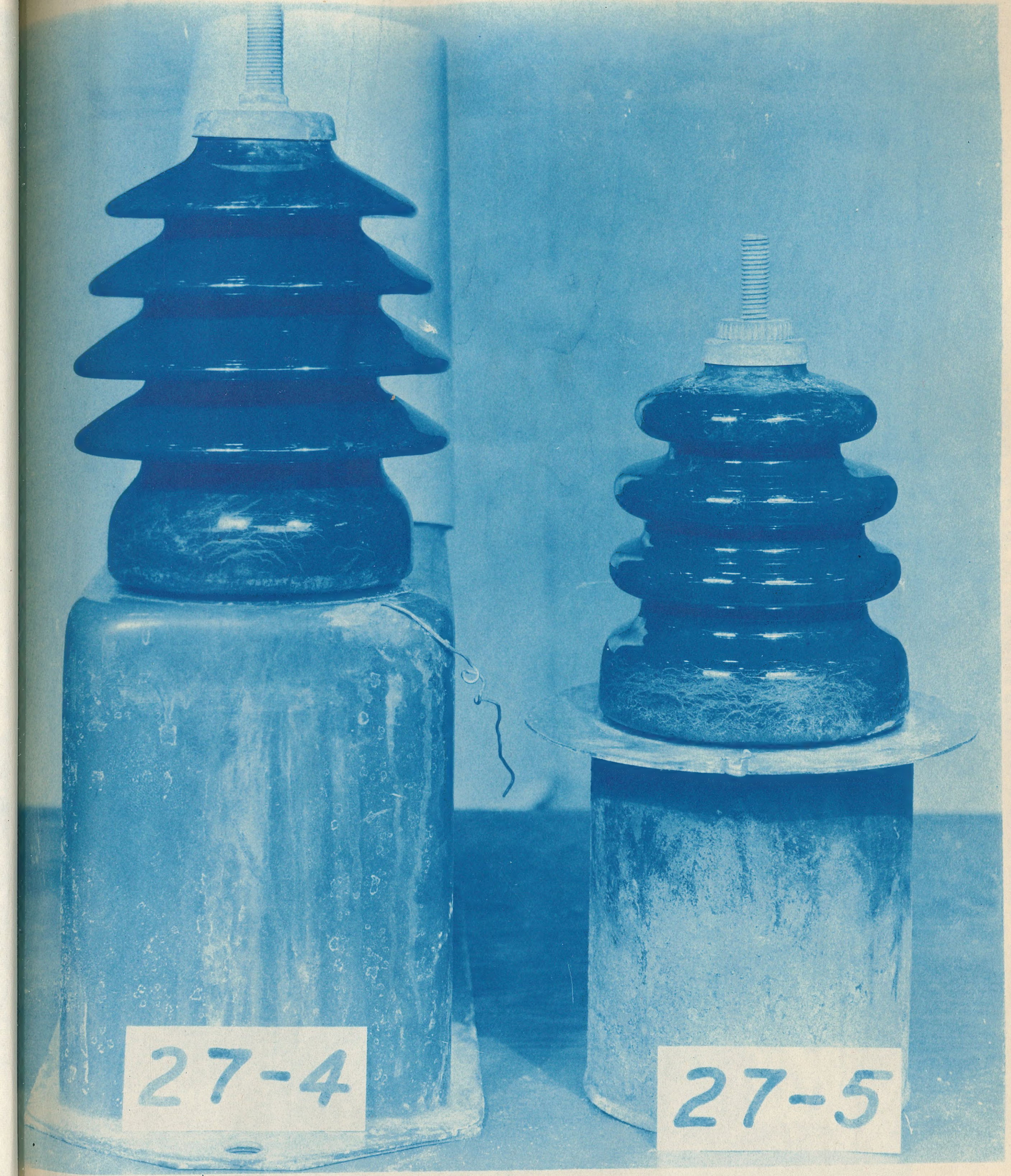

(A) OVERSIZE 5KV PORCELAIN BUSHING (B) STANDARD 5KV PORCELAIN BUSHING

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3017369 FIGURE II RESULTS OF A 300 HOUR SALT RUN ON 5KV PORCELAIN BUSHINGS

1-15-51

(A) 5KV - 14B4 (B) 8.7KV - 14B5 (C) 8.7KV - 14B25

3017365 FIGURE III RESULTS OF A 300 HOUR SALT RUN ON 5KV G.E. GLASS BUSHINGS

1-15-51

Transformer and Allied Product Divisions

(A) 1.5 MEGOHM (B) 70 MEGOHM (C) 150 MEGOHM

3017366 FIGURE IV RESULTS OF A 50 HOUR SALT RUN ON 5 KV G. E. GLASS BUSHINGS PARTIALLY COATED WITH RESCON

6

Transformer and Allied Product Divisions 3017871

(A) 3 MEGOHM (B) 50 MEGOHM (C) 300 MEGOHM

FIGURE V RESULTS OF A 100 HOUR SALT RUN ON 5 KV G. E. GLASS BUSHINGS PARTIALLY COATED WITH RESCON.

2/21/51

Transformer and Allied Product Divisions

3018021

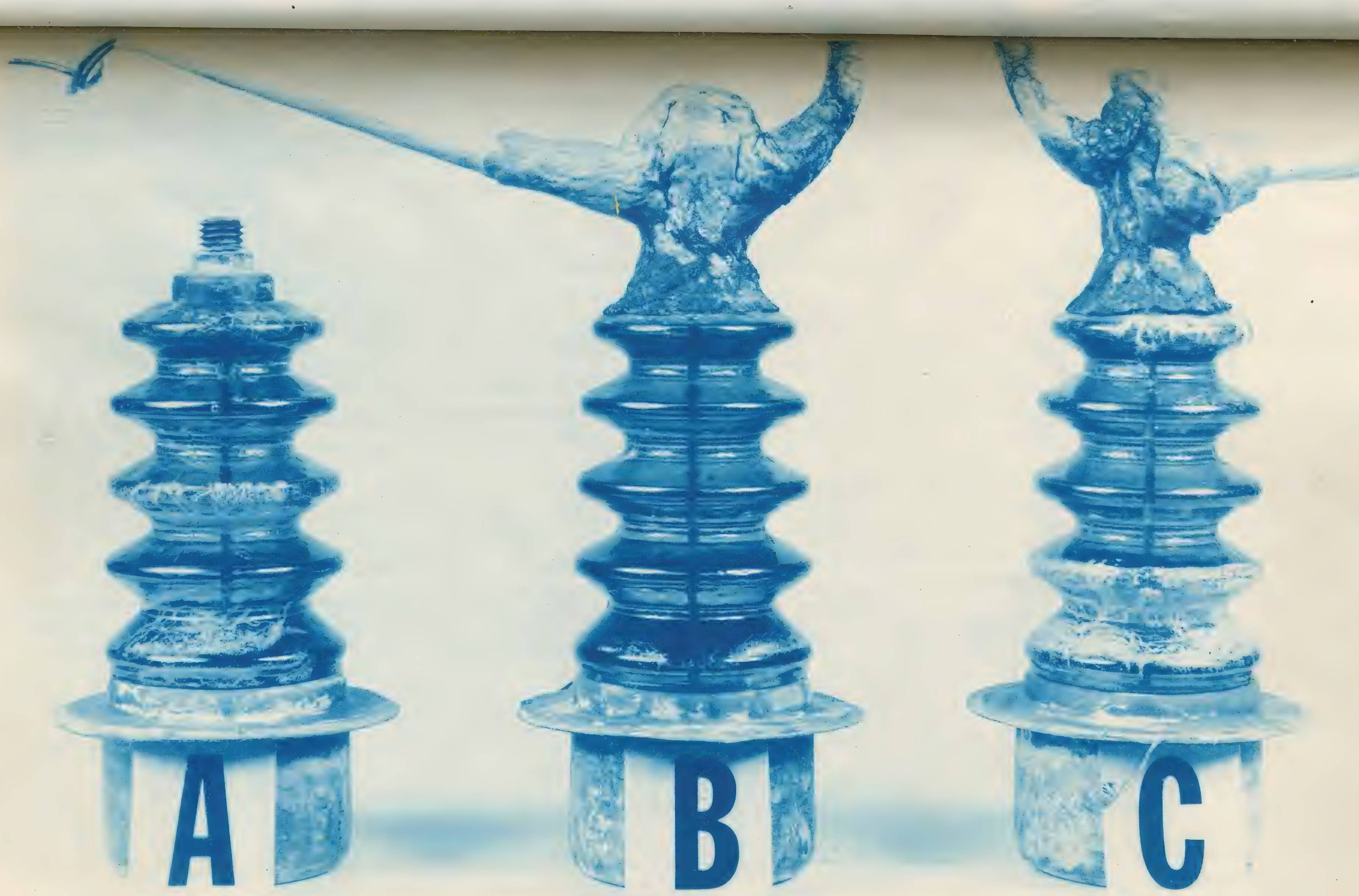
(A) 2760 MEGOHM (B) 9000 MEGOHM (C) 2860 MEGOHM (D) 0 MEGOHM
(E) 42000 MEGOHM (F) 855 MEGOHM

FIGURE VI RESULTS OF A 100 HOUR SALT RUN ON 5KV G. E. GLASS BUSHINGS WITH INTERNAL RESCON COATING CONNECTING TOP TERMINAL TO GROUND FLANGE

3-9-51

(A) 5 KV G.E., 14B4 WITH KEARNY AIRSEAL (B) 5 KV G.E. 14B4 (C) 8.7 KV G.E. 14B5

FIGURE VII RESULTS OF A 100 HOUR SALT RUN ON G.E. GLASS BUSHING. ONE BUSHING HAVING TERMINAL AND CABLE JUNCTION SEALED WITH KEARNY AIRSEAL.



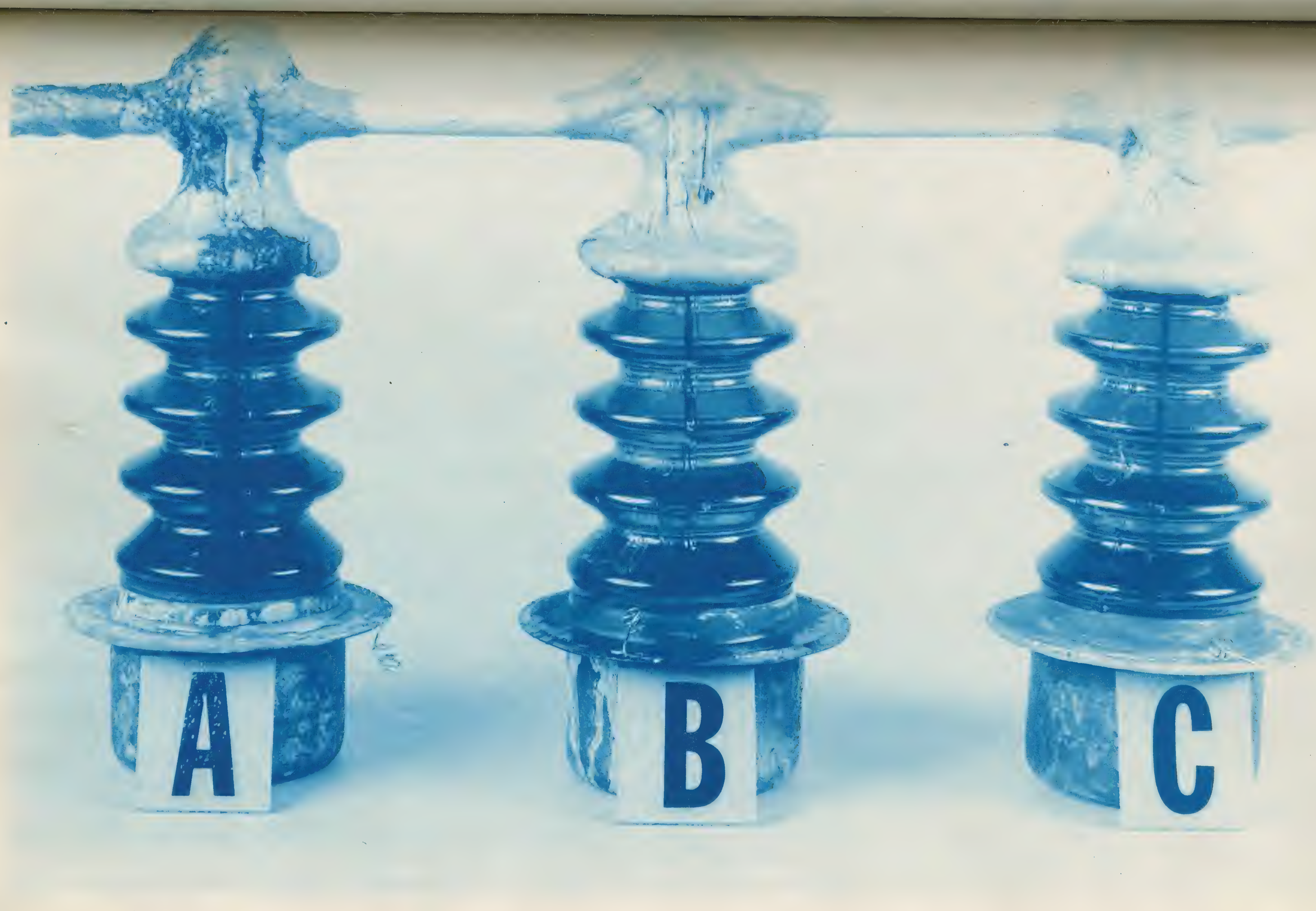
Transformer and Allied Product Divisions

3019157

(A) BUSHING #1	(B) BUSHING #2	(C) BUSHING #3
NO AIRSEAL PROTECTION	AIRSEAL OVER TERMINAL AND CONNECTION	AIRSEAL OVER TERMINAL AND CONNECTION

RESULTS OF A 120 HR. SALT-FOG TEST ON 5 KV G.E. GLASS BUSHINGS
INSUFFICIENT KEARNEY "AIRSEAL" USED ON TERMINALS.

6/5/51



Transformer and Allied Product Divisions

3019243

(A) BUSHING #1 (B) BUSHING #2 (C) BUSHING #3

FIGURE IX RESULTS OF A 359 HOUR SALT FOG TEST ON 5KV G.E. GLASS BUSHINGS - TERMINALS COVERED WITH TWO 1/8" x 3" x 4" PADS OF KEARNEY "AIRSEAL" AND CONNECTED TO VOLTAGE SOURCE WITH ROME 2TW MOISTURE RESISTANT CABLE.

6-11-51

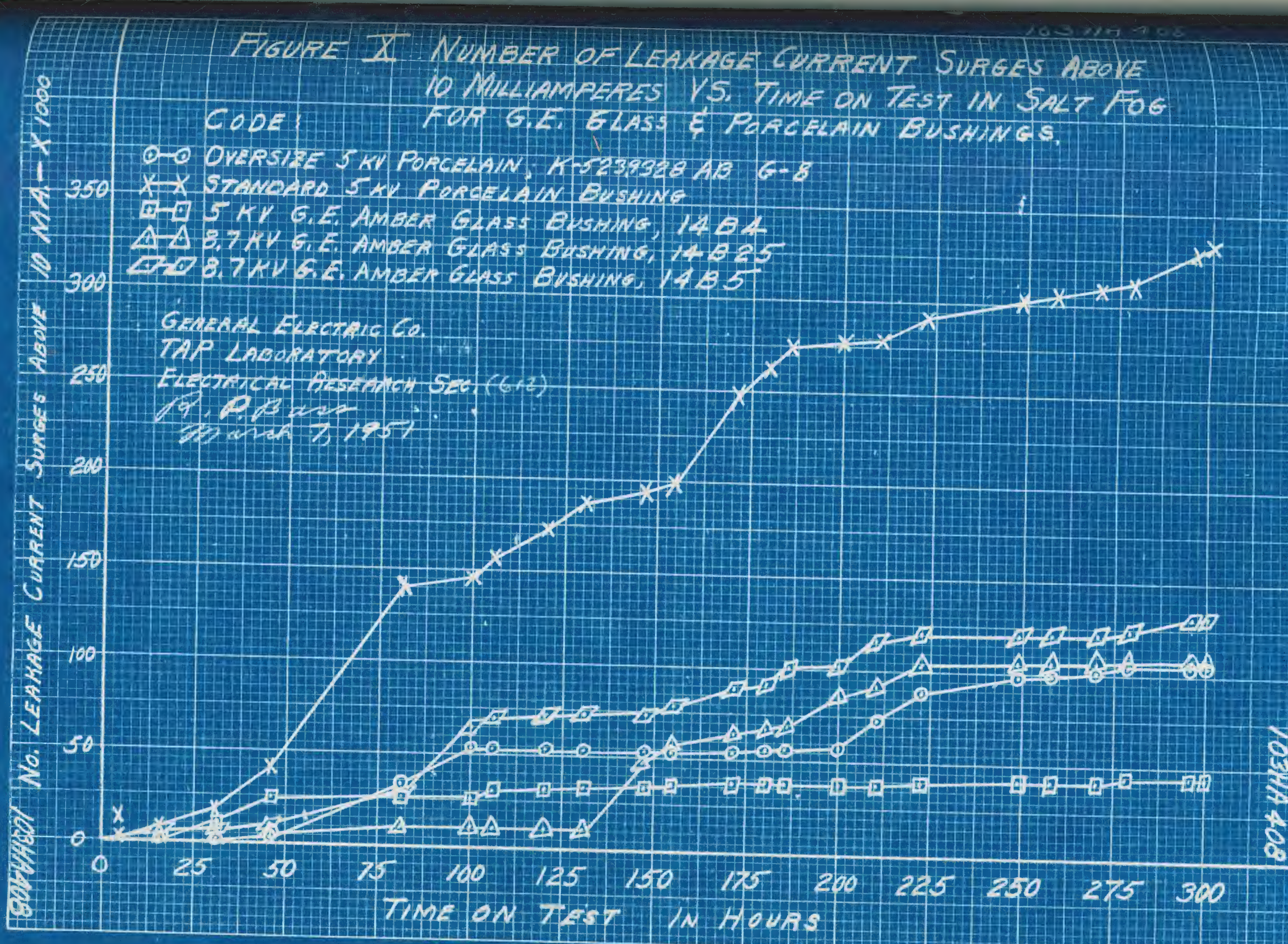


FIGURE X NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MILLIAMPERES VS. TIME ON TEST IN SALT FOG FOR G.E. GLASS & PORCELAIN BUSHINGS.

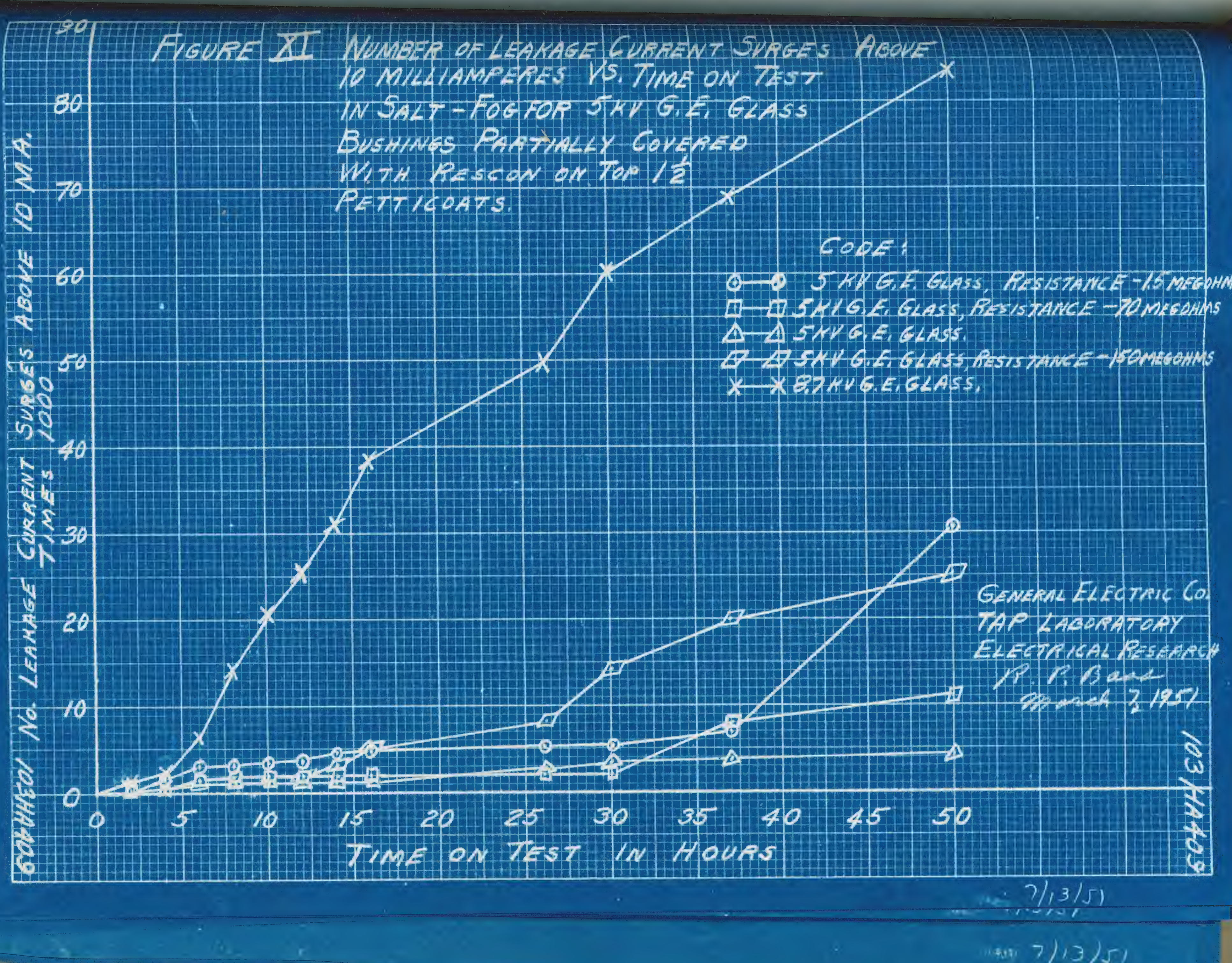
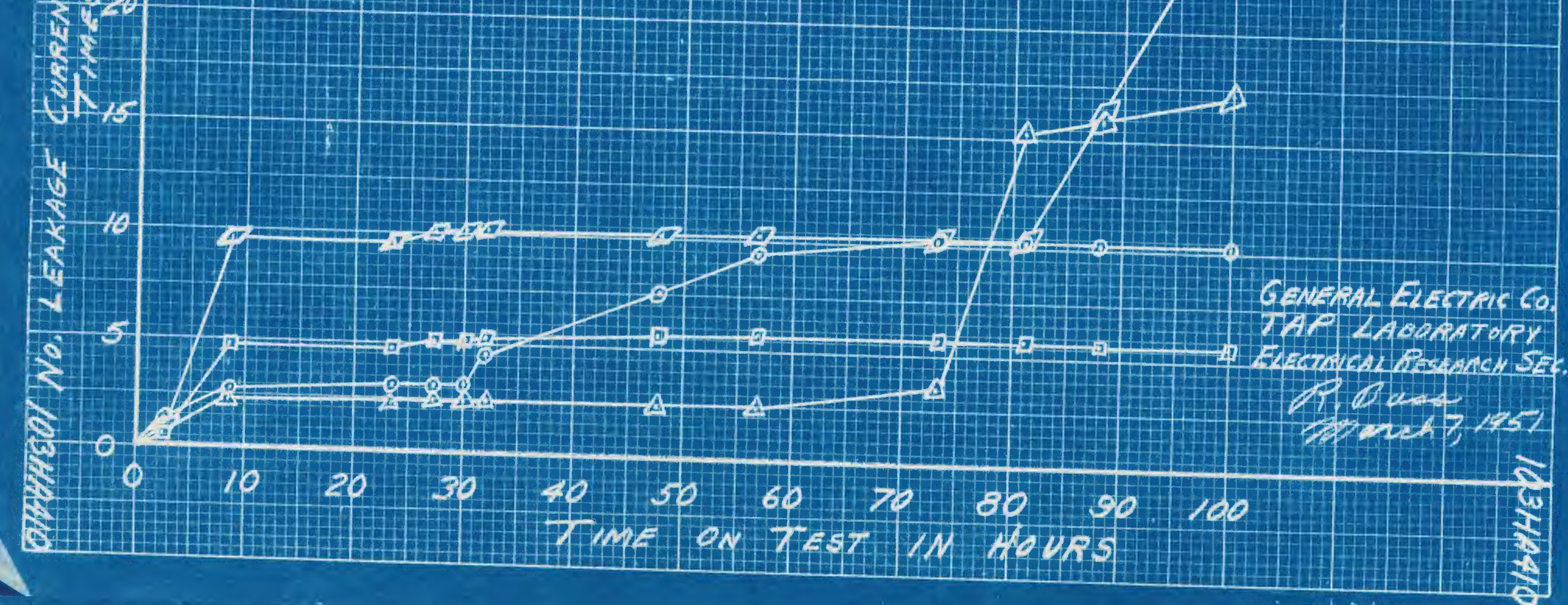


FIGURE XI NUMBER OF LEAKAGE CURRENT SURGES ABOVE
10 MILLIAMPERES VS. TIME ON TEST
IN SALT-FOG FOR 5 KV G.E. GLASS
BUSHINGS PARTIALLY COVERED
WITH RESCON ON TOP 1 1/2
PETTICOATS.
CODE:
5 KV G.E. GLASS, RESISTANCE - 1.5 MEGOHMS
5 KV G.E. GLASS, RESISTANCE - 70 MEGOHMS
5 KV G.E. GLASS.
5 KV G.E. GLASS, RESISTANCE - 150 MEGOHMS
8.7 KV G.E. GLASS.
GENERAL ELECTRIC CO.
TAP LABORATORY
ELECTRICAL RESEARCH
R. P. Band
March 7, 1951
No. LEAKAGE CURRENT SURGES ABOVE 10 M.A. TIMES 1000
TIME ON TEST IN HOURS
0
10
20
30
40
50
60
70
80
90
5
15
25
35
45
103HA409
103HA409
7/13/51
7/13/51

FIGURE XII NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MILLIAMPERES VS. TIME ON TEST IN SALT FOG FOR 5 KV G.E. GLASS BUSHINGS PARTIALLY COVERED WITH RESCON ON BOTTOM 1½ PETTICOATS.



103HA410

7/13/51

7/13/51

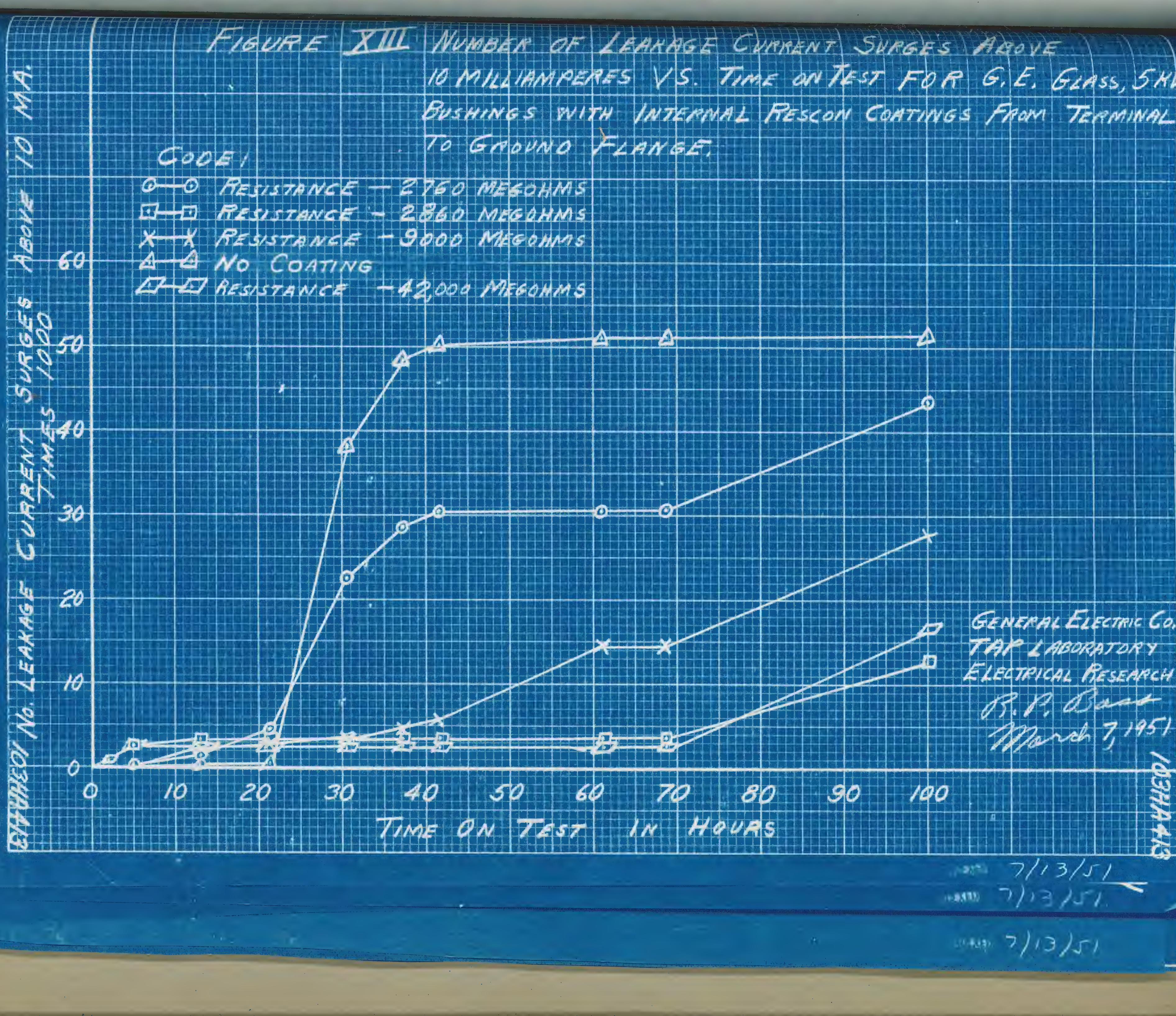


FIGURE XIII NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MILLIAMPERES VS. TIME ON TEST FOR G.E. GLASS, 5 KV BUSHINGS WITH INTERNAL RESCON COATINGS FROM TERMINAL TO GROUND FLANGE.
CODE:
RESISTANCE — 2760 MEGOHMS
RESISTANCE — 2860 MEGOHMS
RESISTANCE — 9000 MEGOHMS
NO COATING
RESISTANCE — 42,000 MEGOHMS
NO. LEAKAGE CURRENT SURGES ABOVE 10 MA. TIMES 1000
0
10
20
30
40
50
60
70
80
90
100
TIME ON TEST IN HOURS
GENERAL ELECTRIC CO.
TAP LABORATORY
ELECTRICAL RESEARCH
R. P. Bass
March 7, 1951
103HA413
7/13/51
7/13/51
7/13/51

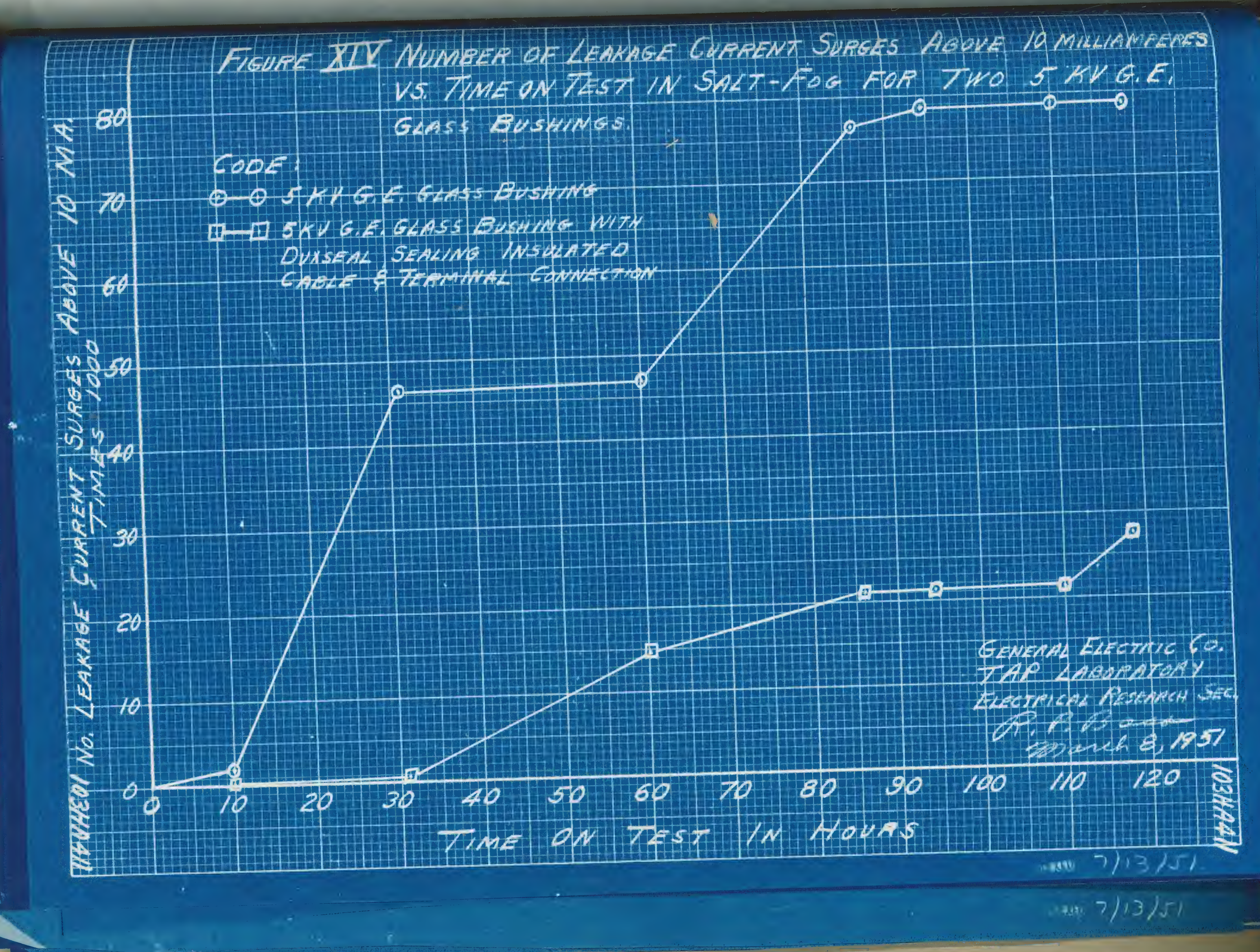


FIGURE XIV NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MILLIAMPERES VS. TIME ON TEST IN SALT-FOG FOR TWO 5 KV G.E. GLASS BUSHINGS.
CODE:
5 KV G.E. GLASS BUSHING
5 KV G.E. GLASS BUSHING WITH DUXSEAL SEALING INSULATED CABLE & TERMINAL CONNECTION
No. LEAKAGE CURRENT SURGES ABOVE 10 MA. TIMES 1000
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
60
70
80
90
100
110
120
TIME ON TEST IN HOURS
GENERAL ELECTRIC CO.
TAP LABORATORY
ELECTRICAL RESEARCH SEC.
March 8, 1951
103HA4II
7/13/51
7/13/51

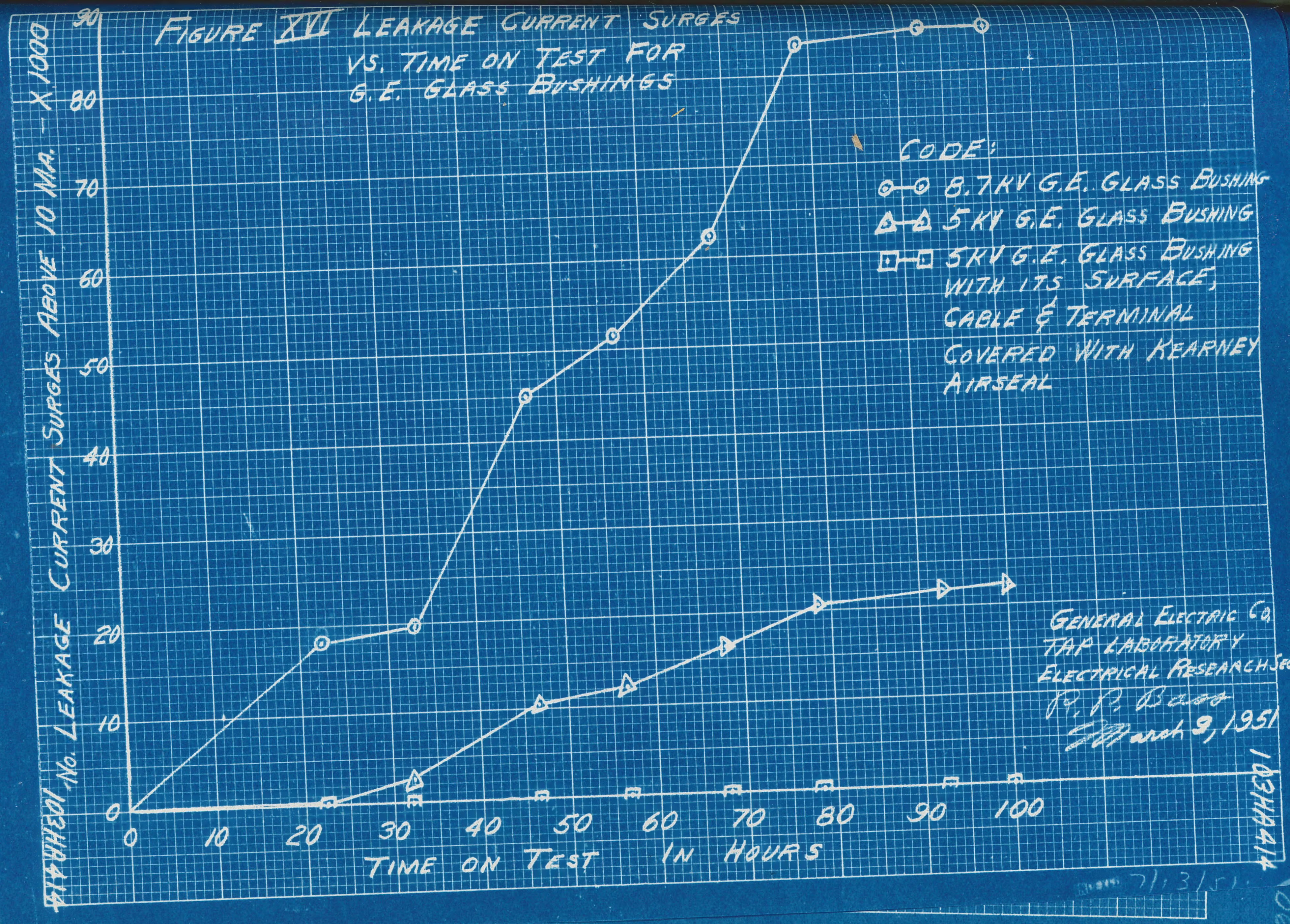
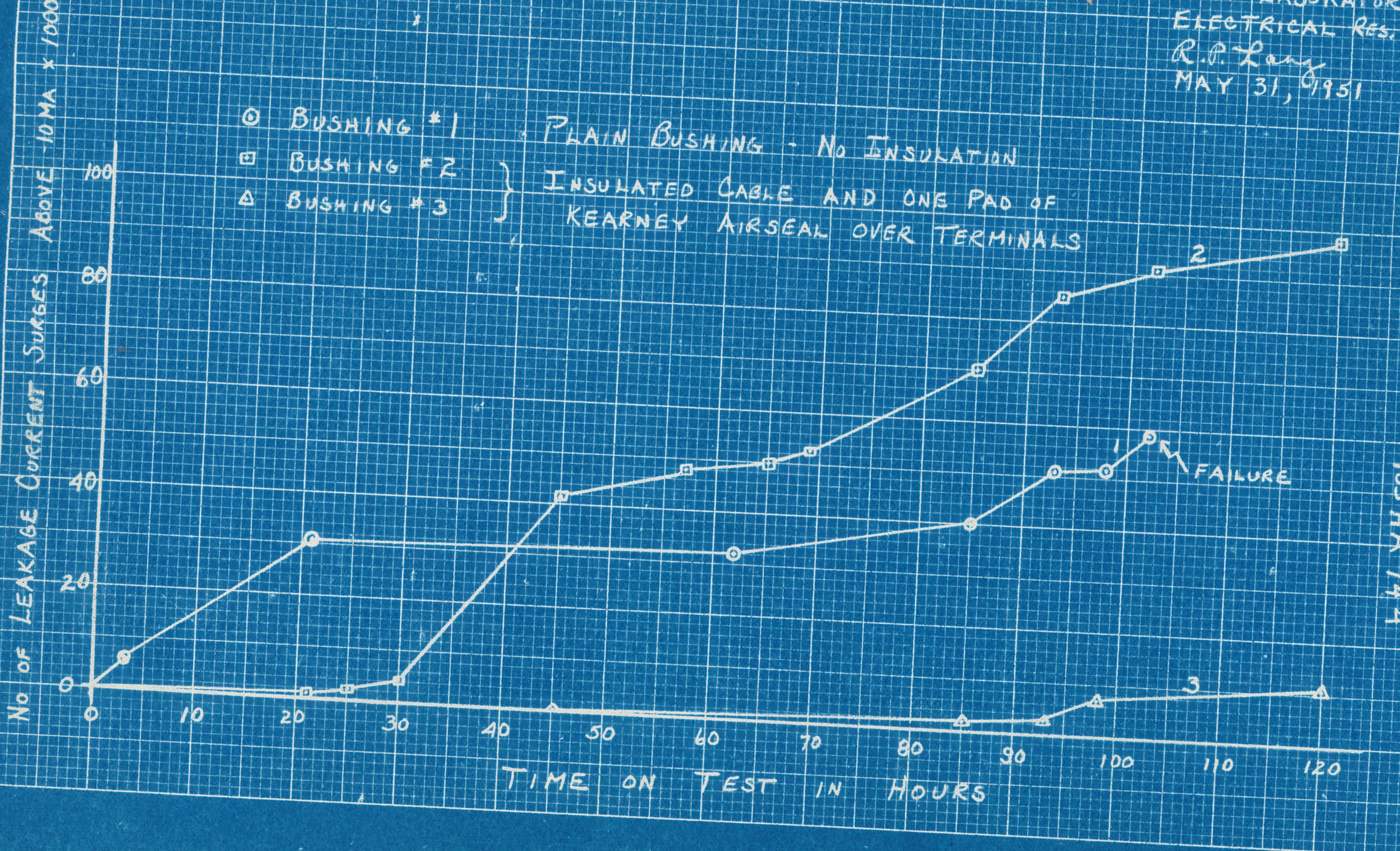


FIGURE XVI LEAKAGE CURRENT SURGES
VS. TIME ON TEST FOR
G.E. GLASS BUSHINGS
CODE:
8.7 KV G.E. GLASS BUSHING
5 KV G.E. GLASS BUSHING
5 KV G.E. GLASS BUSHING WITH ITS SURFACE, CABLE & TERMINAL COVERED WITH KEARNEY AIRSEAL
GENERAL ELECTRIC CO.
TAP LABORATORY
ELECTRICAL RESEARCH SEC.
R. P. Bass
March 9, 1951
No. LEAKAGE CURRENT SURGES ABOVE 10 MA. - X 1000
0
10
20
30
40
50
60
70
80
90
100
TIME ON TEST IN HOURS
103HA414
103HA414
7/13/51

FIGURE XVII

NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MA.
VS. TIME ON TEST IN SALT FOG
FOR 5KV GE 1484 GLASS BUSHINGS

GENERAL ELECTRIC CO.
TAP. LABORATORY
ELECTRICAL RES. SEC.
R. P. Lang
MAY 31, 1951



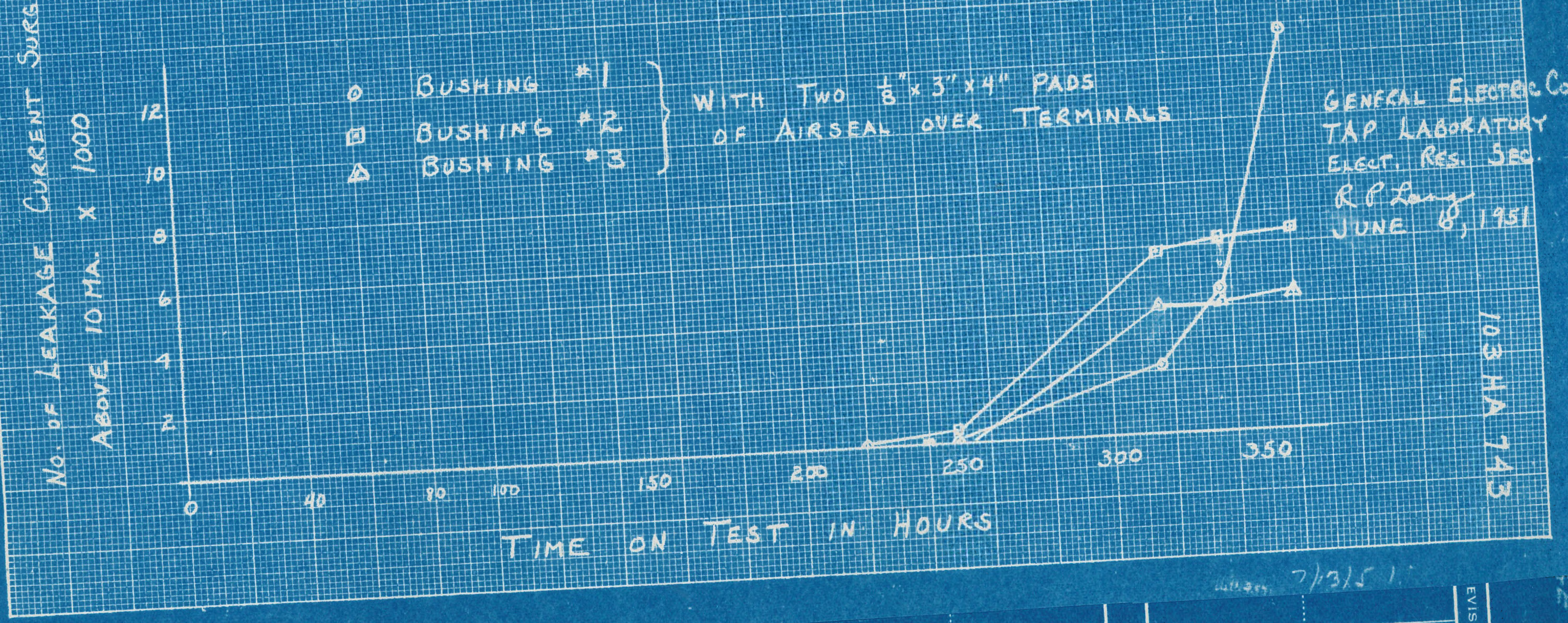
GENERAL ELECTRIC

103 HA 744

103 HA 406

7/13/51

FIGURE XVIII NUMBER OF LEAKAGE CURRENT SURGES ABOVE 10 MA
VS. TIME ON TEST IN SALT FOG
FOR 5 KV GE GLASS 1484 BUSHINGS
WITH KEARNEY AIRSEAL OVER TERMINALS
AND ROME 2TW CABLE TO VOLTAGE SOURCE



GENERAL ELECTRIC

103 HA 406

CONT ON SHEET SH NO.

REV NO.

TITLE SCHEMATIC DIAGRAM OF LEAKAGE CURRENT SURGE COUNTER

CONT ON SHEET SH NO.

FIRST MADE FOR R. BASS

REVISIONS

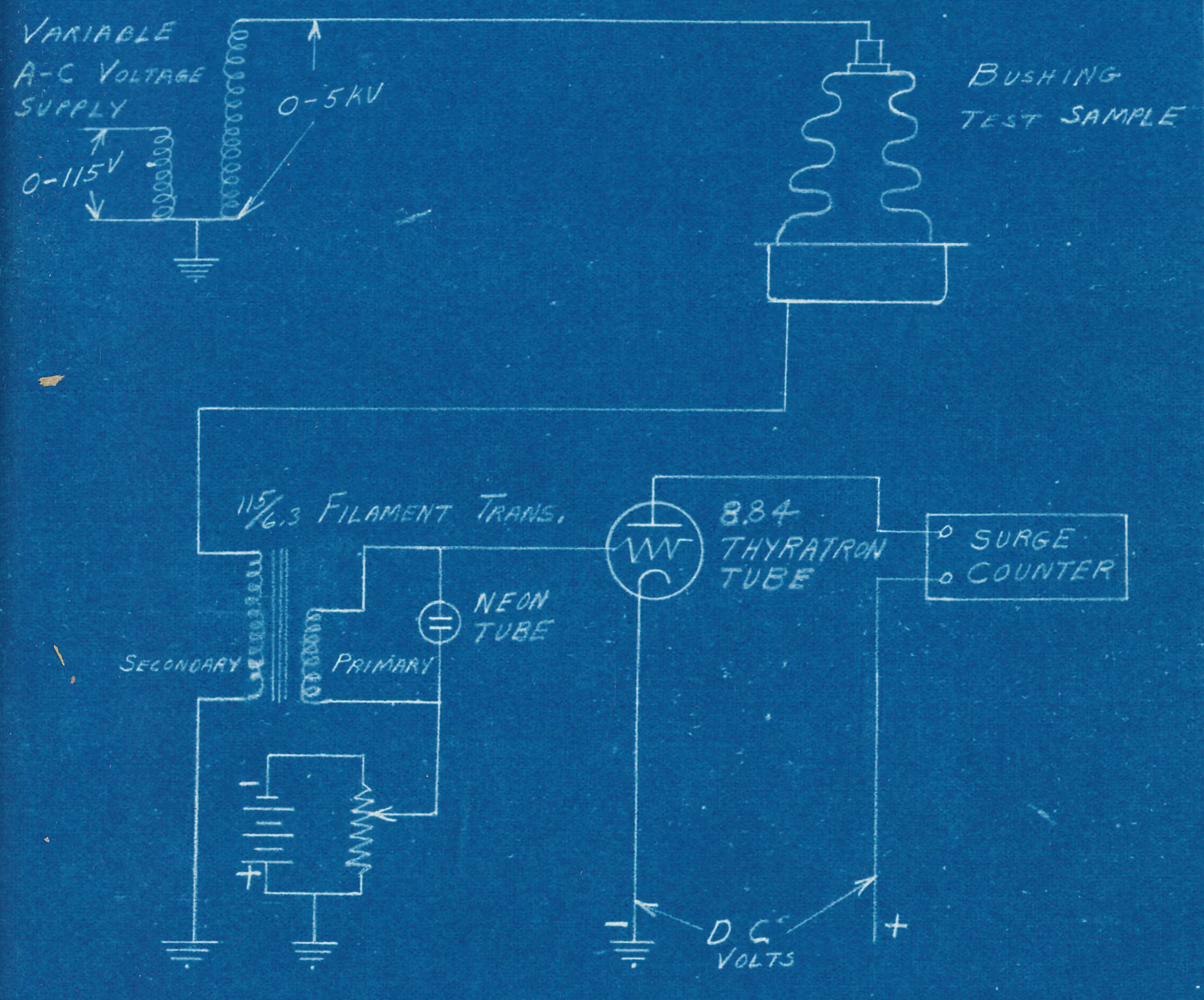


FIGURE XIX SINGLE STAGE SCHEMATIC DIAGRAM OF SIX STAGE LEAKAGE CURRENT SURGE COUNTER FOR USE ON TEST SAMPLES IN SALT-FOG TESTS.

PRINTS TO

MADE BY R.P. Bass

ISSUED March 12, 1951

APPROVALS

DIV

TAP LAB. PITTSFIELD WORKS

103 HA 406

CONT ON SHEET SH NO.

612

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